

## CEC Hazard Tree Project

### Fuels Specialist Report

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#### Existing Condition

Within the project area two plant association groups (PAGs) exist, which are groups of plant communities occurring across the landscape based on management actions and/or lack of disturbance (Volland 1985). Dry ponderosa pine PAG makes up the majority of the 40-acre project area, with a small contingent of wet mixed conifer. As such, stands within the project area make up a larger landscape of fire-adapted ecosystems due to the extensive fire history within Central Oregon. According to the Metolius Late Successional Reserve Assessment (LSRA), fuel loads within various stand types were defined as either Low (5 to 15 tons per acre), Medium (15 to 25 tons per acre), and High (25+ tons per acre). The entirety of the project area falls within late successional reserve, thus suggested fuel loading levels will follow LSRA standard for each PAG.

Within the project area, two fire regime groups exist illustrating a frequent pattern of fire occurrence across the landscape. A fire regime is a classification group based on frequency and character of fires on a given landscape which is influenced by factors such as vegetation, weather, and climate patterns. Table 1 below shows the breakdown of fire regime groups found within the project area.

Table 1. Fire regime group by percentage of project area.

Group	Frequency (years)	Severity	Vegetation Characteristics	Project Area Percentage
I	0-35	Mostly low-severity fires in the understory; generally replaces less than 25% of the overstory	Dry and wet site Ponderosa pine with a grass and shrub understory; generally light fuel loading due to frequent fire	98.7
III	35-100	Low to mixed-severity fires with some replacement severity	Dry site Ponderosa pine shifting west to the interface with dry and moist mixed conifer; low to moderate fuel loading	1.3

## Current Fuel Models

The 40-acre project area contains a variety of fuel models including grass/shrub, downed logs, needle/leaf litter, and grass/shrub/timber litter fuel models. Table 2 illustrates a breakdown of the fuel models within the project area as well as adjectives assigned to describe rate of spread (chains per hour) and flame length in feet, using Scott and Burgan's 40 fuel models, gathered from 2014 Landfire data and ocular surveys. Using the Photo Series for Quantifying Natural Forest Residues: Southern Cascades, Northern Sierra Nevada, which is an ocular assessment utilizing a representative photo series collection, a range of fuel loading in tons/acre can be estimated at approximately 3 tons/acre to 10 tons/acre. Areas in which dead and down woody debris is light and leaf/needle litter with light shrubs is present, approximately 3 to 5 tons/acre is reasonable. In areas of moderate to heavy concentrations of 9" + diameter at breast height (DBH) woody debris, current fuel load accumulations may be as high as 10 tons/acre.

Table 2. Fuels models within the project area and fire behavior characteristics.

Fuel Model/ Descriptor	% of Project Area	Fire Behavior Characteristics (Rate of spread and flame length)
GS1/Low Load Dry Climate Grass/Shrub	4%	Moderate fire spread rate and low flame length
GS2/Mod Load Dry Climate Grass/Shrub	49%	High fire spread rate and moderate flame length
TU1/Low Load Dry Climate Timber/Grass/Shrub	17%	Low fire spread rate and low flame length
TU5/Very High Load Dry Climate Tim/Shrub	8%	Moderate fire spread rate and moderate flame length
TL3/Moderate Load Conifer Litter	1%	Very low fire spread rate and low flame length
TL4/Small Downed Logs	6%	Low fire spread rate and low flame length
TL6/Mod Load Broadleaf Litter	3%	Moderate fire spread rate and low flame length
TL7/Large Downed Logs	2%	Low fire spread rate and low flame length
TL8/Long-Needle Litter	3%	Moderate fire spread rate and low flame length
*Not Occupied/No Data	7%	N/A

\*No data is most likely attributed to roads, bare ground, and water where fuel model data is not available, and a fire would not carry in these environments.

Scott and Burgan's guide describes adjective definitions for rate of spread (how quickly a fire travels 66 feet) and flame length within each fuel model. The table below defines those metrics.

Table 3. Scott and Burgan's adjective definitions for predicted fire behavior.

Adjective Class	ROS (chains/hour)	Flame Length (feet)
Very Low	0-2	0-1
Low	2-5	1-4
Moderate	5-20	4-8
High	20-50	8-12
Very High	50-150	12-25
Extreme	>150	>25

### **CWPP and WUI Designation**

The entire project area is considered Wildland Urban Interface (WUI), an area within or near an at-risk community (Greater Sisters Country Community Wildfire Protection Plan 2019).

Communities closest to the project area are Camp Sherman and homes within the Indian Ford area. As such, these areas are prioritized for hazardous fuels treatments in order to protect public and fire personnel within these areas during the event of a wildfire. Figure 1 below illustrates the most recent 10 years of fire history (2008-2018) within a ½ mile buffer around the project area. From 2008 to 2018, initial attack fire suppression resources detected and extinguished 15 fire starts within the ½ mile buffer, showing the fire prone nature of the landscape.

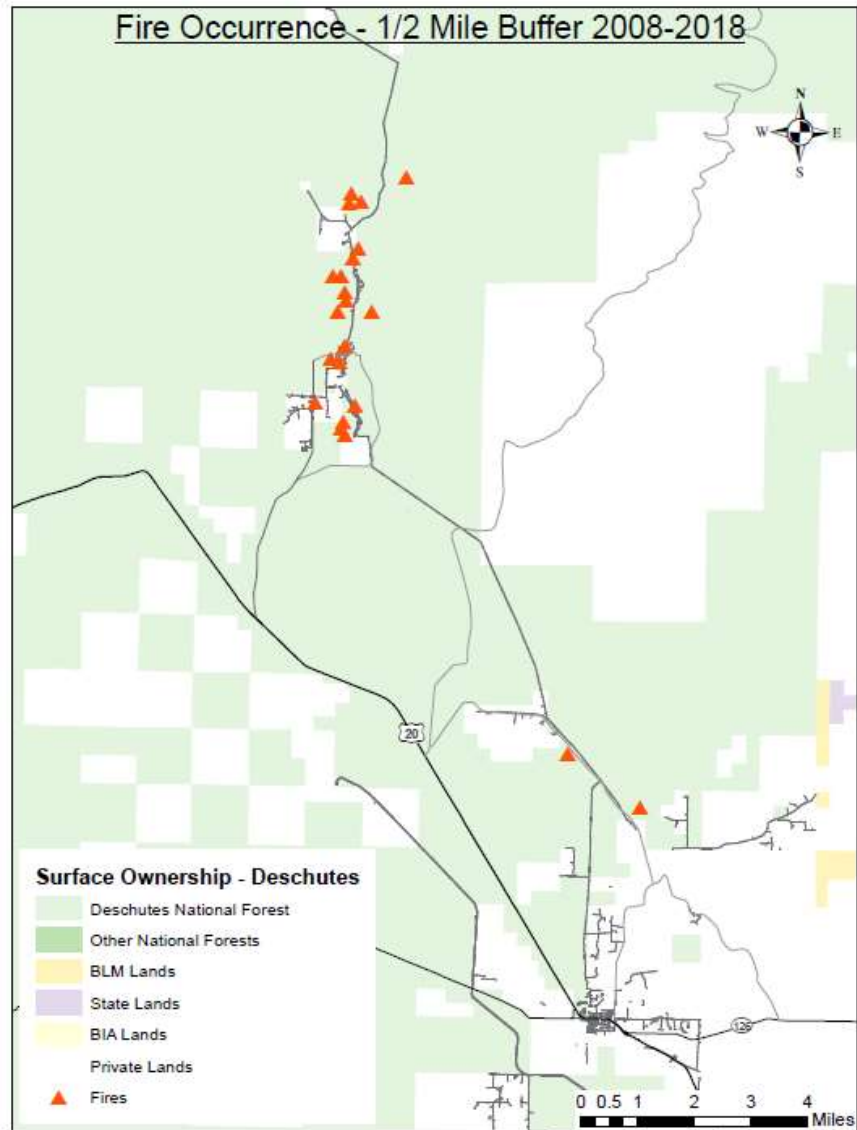


Figure 1. Fire history along CEC Hazard Tree project boundary.

### Desired Condition

Quantitative fuel loading for the project area should follow Table 4 for each PAG. It should be noted, the vast majority of the project area contains dry-site plant species, therefore maximum fuel loading in those areas is 10 tons/acre. Remaining areas such as the wet mixed conifer PAG, which is a small portion of the area, should not exceed 25 tons/acre whenever possible. These standards should be commensurate with course woody debris standards within riparian reserves. However, in instances where conflicts arise between LSRA course wood standards and standards for riparian reserves, preference should be given to riparian reserve standards to meet Aquatic Conservation Strategy (ACS) and course woody debris (CWD) objectives.

Table 4. Plant association groups within the project area and associated fuel tonnage recommendations from the Metolius LSRA.

<b>PAG Name</b>	<b>Descriptor</b>	<b>Max. Fuel Loading (tons/acre)</b>
Climatic MCW	Climatic mixed conifer wet	25
Fire PPD	Fire climax ponderosa pine dry	10

## Alternatives

Under the no action alternative, no management activities would occur to hazard trees along the powerline corridor and tree fall would continue to occur over the next several years. Central Electric Cooperative (CEC) may continue to mitigate snags with an imminent threat to the utility lines, however no means of reducing accumulating fuel loads would exist beyond current planned activities. On-going fuel reduction activities, such as mowing, masticating, and prescribed burning near the project area, would be altered in terms of access and ease of operations due to increased large diameter material near utility lines. In an action alternative, hazard trees along the utility corridor would be systematically felled and associated slash related to harvest activity would be chipped or piled at landings for disposal or alternate uses. Utilizing a comparison of fuel models for the action and no action alternatives is appropriate to assess future wildfire resistance to control through predicted fire behavior (rate of spread and flame length).

## No Action Alternative

Landram, et al. (2002) found that average annual snag fall rates following initial disturbance were 7 percent for ponderosa pine and 4 percent for white fir. In this case, disturbance agents which compromise the integrity of hazard trees vary widely. Some trees which may be cut are living but located in a manner which would most likely fall in time due to wind and ice damage, further damaging existing infrastructure. Large-diameter snags were found to fall at a slower rate than smaller diameter snags, however the introduction of large amounts of dead wood varying in size can be assumed to accumulate over time. Depending on the rate of mortality for hazard trees, the timeline of large woody debris buildup would vary.

Current condition fuel models and associated fire behavior, shown in Table 2, would begin to transition with dead and down buildup and eventually be comparable to a dual fuel model of very high load, dry climate timber-shrub (TU5) and large downed logs (TL7) from Scott and Burgan's fuel model guide. Landfire data currently shows nearly 50% of the project area as occupied with a moderate shrub load and a high percentage of remaining fuel models include an overstory timber aspect. Thus, it is prudent to assume that without management, the shrub layer will continue to grow amidst downed logs from future fuel loading.

Utilizing BehavePlus 6.0.0 fire modeling, a Windows® based computer program that can be used for any fire management application that involves modeling fire behavior and some fire effects, a two-dimensional weighted dual fuel model was used to represent a future wildfire scenario under the no action alternative. Fire weather conditions from the Milli Fire, which burned 24,509 acres in August of 2017, were used to estimate future fire behavior under a TU5 (80% coverage) and TL7. Associated fire behavior is shown below in Table 5, as well as system inputs.

Table 5. Fire behavior modeling inputs and associated outputs for the no action alternative with Scott and Burgan fire behavior adjective definitions.

Weather Inputs					Fire Behavior Outputs	
Midflame Windspeed (MPH)	Live Woody Moisture (%)	1-Hr. Fuel Moisture (%)	10-Hr. Fuel Moisture (%)	100-Hr. Fuel Moisture (%)	Rate of Spread (Ch./Hr.)	Flame Length (Ft.)
					38	15
					Scott/Burgan Adjective Rating	
16	75	4	5	7	High	Very High

In accordance with NWCG Fireline Handbook Appendix B, PMS 410-2 NFES 2165 (Appendix B), flame lengths of 0-4 feet can generally be attacked at the head or flanks by personnel with hand tools and the fire may be held in its current footprint. Flame lengths of 4-8 feet are typically too intense for a direct attack approach and equipment such as dozers and aerial platforms are needed. BehavePlus outputs in this instance estimate flame lengths of 15 feet in which canopy crowning, torching, and major fire runs are common and control efforts at the head of the fire are ineffective.

An increase in large woody debris on the forest floor, especially within the Right of Way (ROW), would most likely limit the ability of mechanical equipment, such as deck mowers and masticators, to reduce surface fuel height for prescribed burning. Thus, wildfire occurrence may result in increased magnitude and intensity due to a lack of maintenance treatments over time. Soil degradation due to increased heat residency and increased burn times in large fuels is possible, potentially leading to hydrophobicity in soils and increased soil erosion (Stephens, et al. 2012).

### Action Alternative

Under the action alternative, hazard trees would be mitigated within the project area and associated slash would be chipped or forwarded to landings and other designated areas where they may be burned or further utilized. The only exception is CWD left on-site to meet Riparian Reserve and Forest Plan standards. Future recruitment of downed wood would be reduced due to eliminating hazard trees under management objectives. It's assumed that the current or increased

levels of fuels treatment maintenance would occur within the ROW due to a lack of hazard trees blocking ingress/egress of mechanical mowing/mastication equipment.

Utilizing BehavePlus 6.0.0 to calculate future wildfire behavior, Table 6 shows weather inputs and fire behavior outputs under an action alternative. Fuel models with a low load dry climate timber-grass-shrub (TU1) component with 85% coverage and low load dry climate grass/shrub (GS1) were used to simulate projected fuel models under an action alternative within the same 2-dimensional weighted dual fuel model as the no action alternative to yield calculated fire behavior estimates.

Table 6. Fire behavior modeling inputs and associated outputs for an action alternative with Scott and Burgan fire behavior adjective definitions.

Weather Inputs					Fire Behavior Outputs	
Midflame Windspeed (MPH)	Live Woody Moisture (%)	1-Hr. Fuel Moisture (%)	10-Hr. Fuel Moisture (%)	100-Hr. Fuel Moisture (%)	Rate of Spread (Ch./Hr.)	Flame Length (Ft.)
					23	6
					Scott/Burgan Adjective Rating	
16	75	4	5	7	High	Moderate

The Appendix B illustrates that in the case of an action alternative, under 80<sup>th</sup>+ percentile conditions, fires are most likely too intense for direct attack at the head and mechanized equipment is required, but control efforts at the head of the fire are still possible with aircraft and additional resources even with high rates of spread. Indirect attack is still likely under these weather conditions; however, ingress and egress of public and fire personnel would be improved due to low levels of large woody debris near the ROW, which is located near several travel routes. As maintenance treatments and wildfires occur, soil degradation would occur to a much lesser extent due to the lack of exposure to heat for extended periods of time.

## Discussion

When comparing fuel models, as well as associated fire behavior, between the action and no action alternatives, resultant fuel models from a no action alternative would lead to higher, more exacerbated fire behavior in the face of future wildfire. Without mitigating slash resulting from hazard trees, rates of spread from future wildfires would be 38 chains per hour and rated as a high spread rating. Flame lengths for this alternative would be 15 feet in length, rating as very high and rendering control efforts at the head ineffective.

In contrast, an action alternative which mitigates most slash and debris from harvest activities associated with hazard tree mitigation results in high rates of spread, 23 chains per hour, and moderate flame lengths of approximately 6 feet. Under this alternative control efforts at the head would require indirect firefighting tactics, however resources such as heavy equipment and aerial

platforms would most likely help stop the spread of a wildfire. Additionally, this alternative supports Greater Sisters Country Community Wildfire Protection Plan goals of preserving safety along infrastructure, such as nearby travel routes and utility lines, through continuous fuels reduction and mitigation efforts.

### **Project Design Criteria**

Project design criteria in relation to fuel loading following harvest of hazard trees should match that of the Metolius LSRA specifications found in Table 4.

Slash resulting from harvest activities should be chipped, piled, or disposed of in a manner that does not exceed specified standards in Table 4, whenever possible. Exceptions to this may include CWD left outside the specified ROW which is needed to meet Forest Plan standards or Aquatic Conservation Strategy objectives.

All harvest-generated slash (bole wood, branches, piles, chips, etc.) must be removed from the ROW so as not to hinder future hazardous fuels reduction activities and to not create fuel accumulation issues.

Machine piles (including landing piles) should be built to specified standards provided by fuels specialists. Equipment must follow specified precautions commensurate with Industrial Fire Precaution Levels (IFPL) during operating seasons.

## References

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